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Buick's New Water Pump

NEW PRE-LUBRICATED TYPE IN PRODUCTION — A REVIEW OF PREVIOUS BUICK WATER PUMP DESIGNS*

By C. J. Slater, Service Department, Buick Motor Division, Flint, Michigan

Improvements in design are not necessarily timed to appear with new car model announcements. All car manufacturers are constantly at work making improvements in units on present production models that, in their estimation, would contribute to better performance, more economical operation or greater car owner satisfaction. To this end, the Buick Motor Division has recently installed a new design of water pump on current production models.

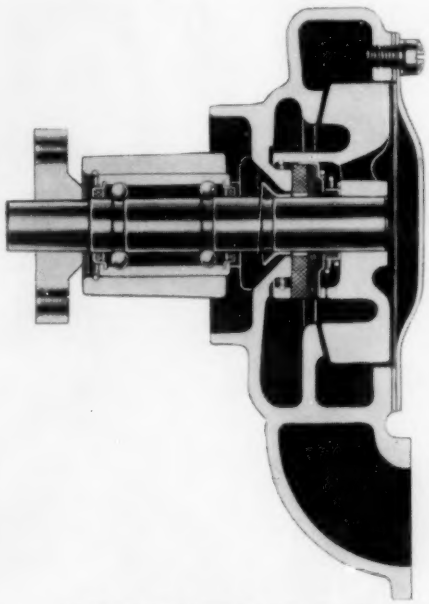
This pump, which is of the ball bearing type, is packed with lubricant at time of manufacture and requires no further attention. The bearing housing is sealed at each end to exclude dirt and water, and the fan is carried on the extended water pump shaft.

The use of this new type water pump started in production on current models with the following engine (not serial) numbers:

Series 40 4-3535259
Series 60, 80, 90 3486434

While this new design of pump was put into standard production on 1938 models starting with the above engine numbers, it is so designed that the unit may also be used for service replacements on Series 40 models as far back as 1934, and on Series 60, 80 and 90 models as far back as 1936. Cars may be encountered in which this replacement has been made, in which case, of course, no lubrication is required, the replacement pump being packed with lubricant at assembly. It may be identified by the absence of any means for applying lubricant.

The water pump bearings on early 1938 Buick production are of the porous bushed type, and require lubrication by filling the oil reservoir completely full with No. 10W Engine Oil every 1,000 miles. An oil heavier than No. 10W should never be used as it will not feed through the porous bushings. When filling the reservoir, care should be taken to make certain that the oil actually runs into and fills the reservoir. A small



NEW TYPE BUICK WATER PUMP

spout oil can which will reach into the oil reservoir should be used. Make sure all air is forced out of the oil reservoir and that it is completely filled. Capacity is approximately 3 oz.

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On 1937 Buick models a water pump similar to that used on the early part of 1938 production was used. While a large reservoir is provided, in which No. 10W Engine Oil is recommended for both the water pump and fan, the oiler through which the reservoir is filled does not stand out as prominently as on the early 1938 design. There is a possibility that this more or less hidden oil cup might be overlooked and the construction mistaken for the latest packed-at-assembly design. This mistake is possible due to the fact that, as previously pointed out, the new design unit may be used for replacement on former year models. It is, therefore, necessary to be certain of the type and construction of the water pump used so that correct service may be given.

Since the new packed-at-assembly type of water pump may be used as a replacement unit on 1936 Buick models also, it may be desirable to review the lubrication requirements of the water pumps used in production on these models.

On the 1936 Series 40 two oil cups are used, one for the water pump bearing and one for the fan bearing. Engine Oil every 1,000 miles is recommended for both points on this series. The oil cup for the fan bearing is reached through a hole in the fan pulley hub. This construction was also used in production on 1934-35 Series 40 models. However, as previously stated, 1934, 1935 or 1936 Series 40 models may be encountered in which replacement with the new packed-at-assembly pump has been made.

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Technical Data

Condensed from INDUSTRIAL AND ENGINEERING CHEMISTRY, *Vol. 30, Page 550, May, 1938*

ALUMINUM STEARATE TYPE GREASES

FRANCIS J. LICATA

One of the chief items which has demanded the attention of grease makers has been the production of aluminum stearate greases. This type of grease has the advantage of crystal transparency and customer appeal, relatively high temperature resistance, stability, waterproofness, and the possibility of wide application in a variety of lubrication problems.

The original introduction of aluminum soaps for lubricants seems to have been lost in the dark past of the grease maker's art. They were mentioned by Redwood *(8)* as early as 1898, when their reputation was as bad as that of petroleum oils a half century earlier. However, when their value in nonchatter oils was proved, grease makers again took up the study of this material. As a result of a campaign by metallic soap manufacturers, aluminum stearate began to be used as a base for cup greases. This led to a variety of results, each representing the resources and ingenuity of the investigators. In 1927 Klemgard *(2)* described a test for aluminum stearate to determine its value as a grease base.

With a few exceptions, and then only after being pressed by their own sales departments, grease makers have been reluctant to produce greases from this material. This attitude is not surprising. Investigators were hampered by the total nonexistence of published data.

In 1931 Zublin announced that aluminum soap greases were desirable for rocker arm lubrication *(10)*. This was followed in 1932 by Kopp's directions for the manufacture of lucid compounds *(3)*. A year later the present writer *(4)* called attention to the fact that the consistency of aluminum stearate greases depends on *(a)* quantity and quality of the stearate, *(b)* viscosity of the petroleum oil used, and *(c)* rate of cooling of the hot grease discharged from the kettle.

The use of aluminum soaps has grown tremendously. In addition, words of encouragement are beginning to find their way into the literature. Garlick *(1)* stated in a paper on lubricating greases: "As ingredients in grease manufacture, aluminum soaps are gaining in popularity now that intensive study has revealed the best means of their utilization. One of the main objects in the renewed study of aluminum soap products has been the desire for an all-purpose automotive grease." Wilch *(9)* said that "aluminum soap greases compare closely in structure and lubricating adaptability to calcium soap greases."

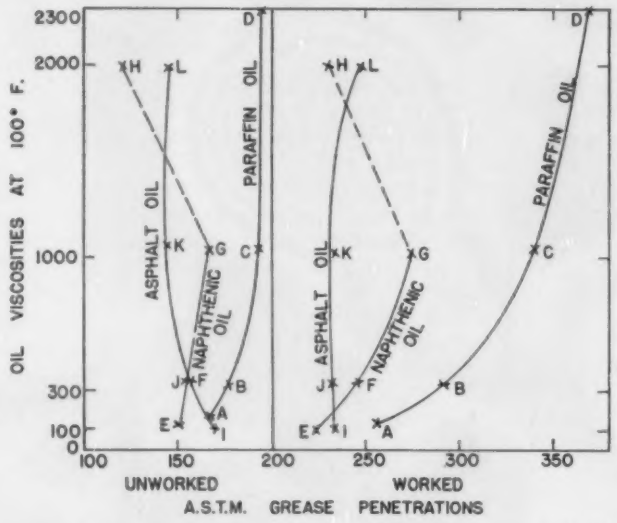

FIGURE 1. EFFECT OF PETROLEUM OIL ON GREASE CONSISTENCY

It was soon realized that the quality of the aluminum stearate used had a great effect on the consistency of grease made from it. Consequently, the writer's company has standardized the manufacture of three types of stearate as the V, R, and GM grades. Recently another firm has designated three similar types as aluminum mono-, di-, and tristearates. The work in this investigation was done with the R type, which corresponds to the distearate.

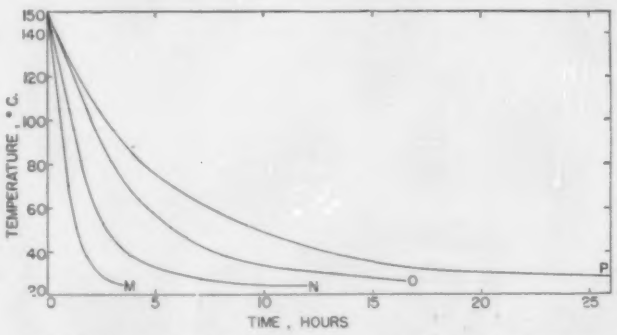

FIGURE 2. COOLING RATE CURVE OF ALUMINUM STEARATE GREASES

Because of the lack of sufficient data, each investigator has had to develop his own technic which would apply to the inherent conditions of his manufacturing equipment. Whenever possible, the stearate manufacturers have co-operated with the grease maker to the end that the sales of both aluminum soaps and greases made from them have shown a healthy growth.

It is believed that enough experience has been obtained to set down certain general rules to serve as adequate guides to those who still have difficulty in the manufacture of this type of grease. These general rules may also serve as a basis for discussion and the foundation for future development.

For this purpose greases were prepared from the same lot of aluminum stearate and oils from various sources and different viscosities to show the effect of the petroleum oil on the consistency. Then, assuming that an asphalt oil with a viscosity of 300 at 100° F. was most desirable economically, several series of grease were prepared to show the effect of *(a)* the rate of cooling, *(b)* moisture and time of compounding, and *(c)* repeated working of this type of grease.

General Procedure

Fifty grams of aluminum stearate were thoroughly mixed with 450 grams of oil, while cold, in a liter Monel metal beaker. The mixture was placed in a pot containing oil to serve as an oil bath. Heat was applied by means of a small electric hot plate, and agitation was furnished mechanically by a stirrer attached to a small drill press driven at 120 r. p. m. When the temperature reached 150° C., the grease was transferred into one-pound tin cans, which were 3 inches (7.6 cm.) in diameter and 4.5 inches (11.4 cm.) high; the cans were immediately placed in a Freas drying oven at 105° C., and the current was then shut off to give a constant rate of cool-

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The construction of the water pump and fan assembly used in production on 1936 Series 60, 80 and 90 models is different in that a ball bearing, packed at assembly and requiring no further lubrication, is provided for the fan. The water pump bearing is provided with a covered fitting and lubrication with Graphite Water Pump Grease every 1,000 miles is recommended.

This brief review of the different water pump constructions and designs and the lubrication variations encountered as designs change, clearly points out the necessity of always being sure the correct lubricant is used and exact lubrication instructions followed for each individual model.

*Latest Factory Recommendations**

AMERICAN BANTAM (60) — 1938 — Following capacities supersede former recommendations: Crankcase 3 qt., instead of 2½ qt.; Cooling System 4 qt., instead of 7 qt. Correct tire size is 5.00 x 15.

INTERNATIONAL TRUCKS — All Models for All Years—Viscous Chassis Lubricant is now specified where formerly the recommendation was Chassis Lubricant.

Fluid Gear Lubricant is now specified for needle or roller bearing type universal joints and splines, instead of Chassis Lubricant which was formerly recommended.

For clutch release bearings equipped with fitting or grease cup, Wheel Bearing Grease is now specified instead of Chassis Lubricant.

For distributor shaft lubrication, where Chassis Lubricant was formerly recommended, Wheel Bearing Grease is now specified.

LINCOLN ZEPHYR—1938—Correct transmission capacity is 3½ pt. or lb. instead of 2½ pt. or lb. The transmission case is the same as that used on 1936-37 models; however, on the 1938 model the transmission case is turned on its side so as to bring the gear shift lever out of the side of the case instead of the top. The shape of the transmission case is such that in the new position an additional pint of lubricant is required to bring it up to the proper level.

Starting approximately May 1, 1938, an intermediate propeller shaft steady bearing has been added to current production and for use in service. This bearing is provided with a lubrication fitting on the propeller shaft housing for application of Chassis Lubricant every 1,000 miles.

LINCOLN ZEPHYR—1936-37-38—The recommendation of Chassis Lubricant for rear wheel bearing lubrication has been changed to Wheel Bearing Grease. The mileage interval remains at 1,000 miles.

CADILLAC REAR SPRINGS—1938—There are no covers on the 1938 Cadillac rear springs, and since the usual procedure is to spray or brush with engine oil where uncovered springs are found, it is important to note that these rear springs must not be lubricated as they are assembled with *waxed liners* between the leaves and to lubricate them in any manner would ruin the ride quality of the car and do more harm than good.

CHEVROLET MASTER AND MASTER DE LUXE—1938. For years the rear spring saddles on these models have been provided with a pressure gun fitting for applying the lubricant. On 1938 models the torque action at this point is absorbed by a rubber mounting. Of course, rubber mounted points should never be lubricated, but the service station attendant may recall that on all Chevrolet models in previous years rear spring saddles have been lubricated, and feel that possibly a few drops of oil from the hand oil can should be applied. *Don't do it!* It's a rubber mounted point.

SHOCK ABSORBER LINKAGES—The same caution applies to these connections. Just a year or so ago pressure gun fittings for applying Chassis Lubricant to these points were found on several models, and are still found on the 1938 Pierce-Arrow cars. These linkages on the majority of 1938 cars are now rubber mounted and should not be lubricated. However, when a car owner complains of squeaks at these points, it is surprising to see the number of service men who will apply oil from the regular oil can to remove the trouble. *Don't do it!* It's rubber mounted. If the noise is annoying, a vegetable oil such as castor oil may be used. Never use a mineral oil as it will attack the rubber and eventually deteriorate it. Brake fluid or special rubber lubricants may be used.

AUTOMATIC CHOKE LINKAGE — Where this linkage is exposed, the majority of manufacturers do not recommend that it be lubricated. Automatic chokes are quite sensitive to any additional friction, and where oil from the hand oil can is applied it tends to collect dust or become gummy, which retards the free action necessary for proper functioning of the linkage.

HYPOID LUBRICANTS FOR CHRYSLER PRODUCTS—The Chrysler engineering department now advises us that inasmuch as no refiner has found it necessary to go to heavier than SAE 90 for hypoid lubricants, the recommendation as carried on their 1938 models will apply to all Chrysler product cars with hypoid gears. This recommendation is:
Above 0 deg. F—Hypoid Lubricant SAE 90
Below 0 deg. F.—Hypoid Lubricant SAE 80

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ing. Unworked and worked consistencies were determined according to the A. S. T. M. procedure. Variations in the procedure to bring about a special effect will be described later, whenever they occur.

TABLE I. EFFECT OF OIL ON A. S. T. M. GREASE CONSISTENCY

Sample	Oil Viscosity at 100° F.	Unworked Penetration	Worked Penetration	Remarks
		Paraffin Oil		
A	153	166	256	Smooth, no bleeding
B	310	178	287	Same
C	1050	193	340	Same
D	2300	192	370	Same
		Naphthenic Oil		
E	100	152	223	Firm, slight bleeding
F	320	155	246	Smooth, no bleeding
G	1040	169	275	Same
H	2000	120	230	Same
		Asphalt Oil		
I	100	170	234	Granular, bleeding
J	310	153	231	Smooth, no bleeding
K	1040	145	234	Same
L	2000	144	248	Same

Effect of Petroleum Oil

In order to compare the effect of paraffin, naphthenic, and asphalt oils on grease consistency, four oils were obtained from each group, having approximately similar viscosities at 100° F. (37.8° C.) Samples of grease were made from each oil according to the general procedure, and A. S. T. M. penetrations were determined several days after reaching room temperature. One determination was made in the tin cans for the unworked penetration, and an average of two or three observations was taken for the worked consistency. Most samples showed check determinations within four points. Table I and Figure 1 show the data obtained.

Greases made from paraffin or Pennsylvania oils show greater penetration or softness as the viscosity of the oil rises. On the other hand, the penetration readings indicate very little change in the greases made from various asphalt oils. The graphs giving

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the penetration in greases made from naphthenic oils show an anomalous behavior. Up to the 1000-viscosity oil, the greases seem to behave similarly to the paraffin oils in that they become softer as the viscosity rises. However, the penetration of the grease made from the 2000-viscosity oil was almost as low as that from the 100-viscosity oil. This observation led to the discovery of the fact that the presence of moisture and the time of compounding also affect the consistency of aluminum stearate greases. This will be discussed later in greater detail under "Effect of Moisture and Time of Compounding."

Effect of Cooling Rate

One of the chief sources of variation in grease consistency is the rate of cooling. This is easily realized when, by the use of the same formula, a small laboratory batch of a few ounces will cool in a short time to a hard, brittle, granular mass, not at all like a grease; on the other hand, a large batch made in the factory will cool very slowly to a soft, smooth, unctuous, and somewhat adhesive grease. To show the relatively large effect of the rate of cooling, samples similar to *J* were prepared by heating to 150° and cooling to room temperature (25° C.) at various rates (Figure 2).

Sample *M* was cooled within 3 hours by passing cold water around the tin container. Sample *N* was cooled within 12 hours in the oven as described in the general procedure. Samples *O* and *P* were made to cool within 18 and 25 hours, respectively, by various thicknesses of asbestos insulation. Table II and Figure 3 show the data and graphs of the results obtained.

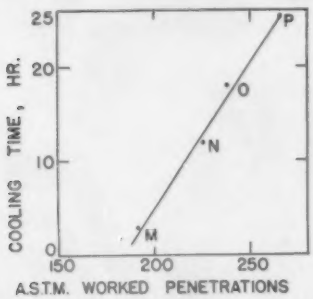

FIGURE 3. EFFECT OF COOLING RATE

It is clear that by using the same formula, the rate of cooling will change the worked A. S. T. M. penetrations from 193 to 267, a difference of 74 points. Moreover, the whole general appearance of the greases was different. Sample *M* showed excessive bleeding or oil separation. With slight pressure it crumbled between the fingers into a coarse, dry powder. Subsequent samples showed increasing softness, smoothness, and a degree of unctuousness as the grease was made to cool more slowly.

TABLE II. EFFECT OF COOLING RATE ON GREASES

Sample	Hours of Cooling	Worked Penetrations	Remarks
M	2	193	Granular, excess bleeding
N	12	225	Smooth, no bleeding
O	18	238	Same
P	25	267	Same

Effect of Moisture and Time of Compounding

The anomalous behavior of sample *H*, made from the 2000-viscosity naphthenic oil, led to the discovery of the fact that this sample had been held at 150° C. several hours longer than others. During this period there was the possibility of finer stearate dispersion into the oil and the loss of moisture held captive in the grease. Moisture determination on samples *G* and *H* revealed 1.2 and 0.7 per cent, respectively.

It is common knowledge that even in this type of grease the presence of moisture affects the consistency. Hence it seemed desirable to make several observations on this phase of grease making.

TABLE III. EFFECT OF MOISTURE AND TIME OF COMPOUNDING

Sample	Hours Held at 150° C.	Worked Penetration	% Moisture in Grease
Q	0	275	0.15
R	1	240	0.12
S	3	225	0.10
T	6	222	0.05

A series of greases were made similar to sample *J* with 10 per cent aluminum stearate in the 310 asphalt oil, and were heated to 150° C. However, the general procedure described above was modified so that the samples were mixed at 150° C. from 0, 1, 3, and 6 hours and then placed in the oven to cool as usual.

The penetrations on the resulting greases showed an increasing hardness as the time of compounding increased and the moisture contents decreased. The data are recorded in Table III and Figure 4.

Miscellaneous Properties of Aluminum Stearate Greases

CONSISTENCY. Greases of this type are ordinarily regarded with apprehension because of their reputed great changes in consistency. This fear is based on the fact that the stearate type of grease is sold on an unworked basis, whereas the consumer is interested in its worked consistency. All greases become softer on working. Therefore, a large percentage of complaints will be eliminated as soon as aluminum stearate greases are sold on a worked basis. It may be of interest to record that sample *J*, with a worked penetration of 231, changed to only 250 with sixty additional strokes of the grease worker and seemed to reach a maximum of 255 with sixty more strokes, bringing the total up to one hundred eighty.

WATERPROOFNESS. Another wrong notion about aluminum stearate greases is that they hydrolyze in the presence of water. An easy way to show that water has no effect is to boil some aluminum stearate grease in water. When the excess is poured off and the remaining water is boiled out, the grease is still as solid and transparent as before the test.

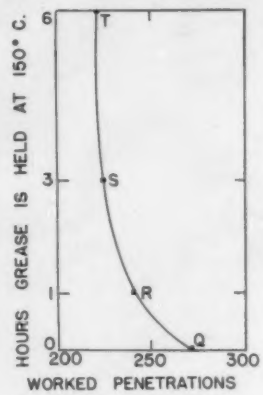

FIGURE 4. EFFECT OF MOISTURE AND TIME OF COMPOUNDING

WIDE APPLICABILITY. With proper modification, aluminum stearate greases may be compounded to obtain an infinite variety of products. The aluminum stearate can itself be changed to have a low or high bodying effect on the oils used. Various grades are sold under trade names for that purpose. Fluxes can be added to the stearate and oil so that the resulting products may be a thickened oil, a stringy adhesive semifluid grease, or a high-melting solid lubricant.

In this connection it is well to state that as little as 5 per cent sodium base or lime grease will liquefy on aluminum stearate grease. Therefore, the need for absolute cleanliness is imperative.

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